

JAPANESE

[JP,2002-105112,A]

Drawing selection

Drawing 1

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION
TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

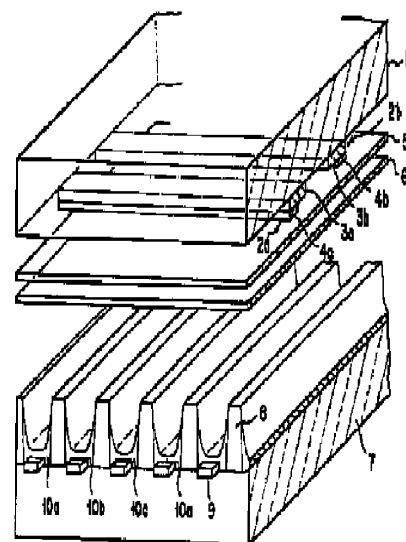
[Field of the Invention]This invention A flat-panel display, for example, a plasma display panel, It is related with the panel which formed the baked material pattern using the septum (barrier rib) pattern of (calling it PDP for short hereafter), the still more useful photosensitive paste composition to formation of a dielectric pattern, an electrode (conductor circuit) pattern, and a black matrix, and it.

[0002]

[Description of the Prior Art]PDP is a planar display which performs presenting of an image or information using luminescence by plasma discharge.

It is classified into DC type and AC type according to panel structure and a drive method.

The principle of the colored presentation by PDP produces plasma discharge in the cell space (discharge space) between the two electrodes which were formed in the front glass board estranged by the rib (septum), and the rear glass substrate and which counter, The fluorescent substance formed in the rear glass substrate inner surface by the ultraviolet rays generated by discharge of gas, such as helium, Xe, etc. which are enclosed in each cell space, is excited, and trichromatic visible light is generated. Although each cell space is divided by a lattice-like rib in DC type PDP and it is divided on the other hand by the rib installed successively in parallel with a substrates face in AC



[Translation done.]

type PDP, also in any, the division of cell space is made by the rib.

[0003] Drawing 1 shows the constructional example of the plane discharge method PDP of 3 electrode structures of a full color display. The display electrode 2a of the couple which comprises the bus electrode 4a for lowering line resistance of the transparent electrode 3a for discharge, or 3b and this transparent electrode or 4b, and 2b are formed in the undersurface of the front glass board 1. On these display electrodes 2a and 2b, the transparent dielectric layer 5 (low melting glass) for accumulating an electric charge is formed by printing and calcination, and the protective layer (MgO) 6 is vapor-deposited on it. The protective layer 6 has roles, such as protection of a display electrode and maintenance of a discharge state.

[0004] On the other hand, on the rear glass substrate 7, the address electrode (data electrode) 9 arranged in the rib (septum) 8 of the stripe shape which divides discharge space, and each discharge space is formed in the predetermined pitch. The fluorescent substance film of red (10a) and three green (10b) and blue (10c) colors is regularly arranged on the inner surface of each discharge space. In a full color display, one pixel comprises a trichromatic fluorescent substance film of red, green, and blue as mentioned above. In the above PDP, since the pulse voltage of exchange is impressed between the display electrode 2a of a couple, and 2b and it is made to discharge by inter-electrode [on the same board], it is called the "plane discharge method." The ultraviolet rays generated by discharge have the structure of exciting the fluorescent substance films 10a, 10b, and 10c of the back substrate 7, spacing the transparent electrodes 3a and 3b of the front substrate 1, and seeing the generated visible light (reflection type).

[0005] In recent years, the demand of densification and highly-minute-izing is increasing in the pattern processing in the circuit board or a display, and material and pattern processing art are also asked for high definition pattern formation with high reliability in connection with it. In particular, the pattern processing in the high definition and the high aspect ratio is expected the high constituent of mineral constituent ratios, such as glass, by septum formation of the plasma display panel.

[0006] As a pattern formation method of the conventional PDP partition wall, various methods, such as screen printing, the sandblasting method, and the lift-off method (it is also called a dry film embedding method), are known. However, screen-stencil has problems, such as alignment accuracy resulting from the level of skill, the blur at the time of printing and a blot, and elasticity of a screen, and its yield is low. And in order to form the septum which is a high aspect ratio since the thickness obtained by one printing has a limit, many times makes it pile each other up, printing is needed, and there is a problem that workability is bad.

[0007] Then, the photolithographic method is proposed as a wall formation method which can be replaced with screen printing (refer to JP,2-165538,A). However, since the sensitivity and resolution of photosensitive paste were low, the work process (printing, exposure, and development) of multiple times was needed for obtaining the thick pattern of a high aspect ratio like screen printing, and there was a problem to which a process becomes long. Namely, when a photosensitive composition forms a coat thin in comparison, it is satisfactory, but when the thickness of film becomes thick, depending on an exposing condition. Poor definition may arise after development with shortage of the photo-curing depth in the case of exposure, and a pattern may get twisted at the time of calcination, and problems, such as ***** contraction and curvature, may occur. Especially the photosensitive paste composition used for formation of baked material patterns, such as a partition pattern, a conductive pattern, a dielectric pattern, Since inorganic powder, such as very small glass particles of particle diameter and metal particles, is contained very so much, the permeability of light becomes insufficient in photo-curing bad therefore in the case of

exposure, and it becomes easy to produce photo-curing unevenness, and such a phenomenon appears easily, so that the thickness of film becomes thick, and, so that it becomes the depths of a coat. Therefore, for thick pattern formation, it needed to carry out by having repeated the above-mentioned process, and there was a problem in respect of workability, accuracy, etc.

[0008]After the sandblasting method applies glass paste to predetermined thickness on the other hand in an entire substrate, After piling up the photosensitive dry film which has blast-proof nature on it and, carrying out pattern NINGU of this photographic sensitive film subsequently to partition shape, it is the method of shaving off the glass paste portion which sprays abrasive powder and is not covered with a film. In this method, although it is possible to form a high definition septum, in order that a lot of grinding powder may come out, work environment gets worse, and there is a problem to which the yield falls. If it scales up to a big screen, problems, like the image quality degradation and the drive margin at the time of it becoming difficult to form the septum of an identical size and panel-izing to whole surface homogeneity, become difficult to get will arise.

[0009]In the lift-off method, it is easy for the photosensitive dry film to be used to carry out pattern NINGU also of the thickness which is about 200 micrometers with a uniform size by the big screen of 40 inches of diagonal class, and this special feature can be used for panel production. In the septum formation by the lift-off method, on the clear glass board in which lower members, such as an electrode, were formed, first, After laminating the photosensitive dry film of predetermined thickness, the photo mask which has a predetermined partition shape pattern is piled up, exposure and development are performed after an appropriate time, the portion of the photographic sensitive film which was not exposed through the photo mask is removed, and a slot is formed. Subsequently, it applies so that glass paste may be embedded, after making the slot of the photographic sensitive film formed by the above-mentioned exposure and development dry and carry out heat cure of this, removal of a photographic sensitive film and calcination of glass paste are performed to it, and a septum is formed in it. Since the septum formed by this method is excellent in dimensional stability as compared with the screen printing and the sandblasting method which were mentioned above, it attracts attention as a method that the high definition septum for PDP can be manufactured by the high yield.

[0010]However, although embedding of the glass paste into the slot of a photographic sensitive film, defoaming under decompression, and desiccation are generally performed in advance of heat curing in the lift-off method, Since glass paste sinks by this defoaming and volatilization of the solvent component in a drying process, it is necessary to embed and to repeat the cycle of - defoaming-desiccation several times, leads to complication of a process, and has become one of the factors which lower productivity. After performing heat-treatment aiming at hardening and exfoliating a photographic sensitive film by a remover further after that, heating at high temperature aiming at calcination is performed. Thus, since many heating processes are needed, a production process is complicated, and energy expenditure becomes large and has become a factor which raises a production cost.

[0011]

[Problem(s) to be Solved by the Invention]This invention is made that the problem of conventional technology which was described above should be solved, and is a thing.

the purpose -- and it is providing the photosensitive paste composition which makes highly precise pattern processing possible.

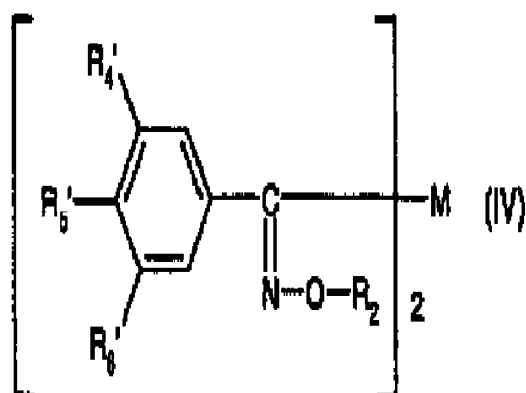
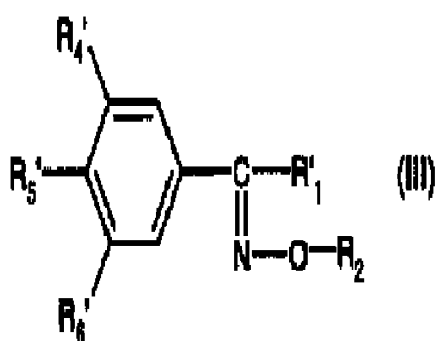
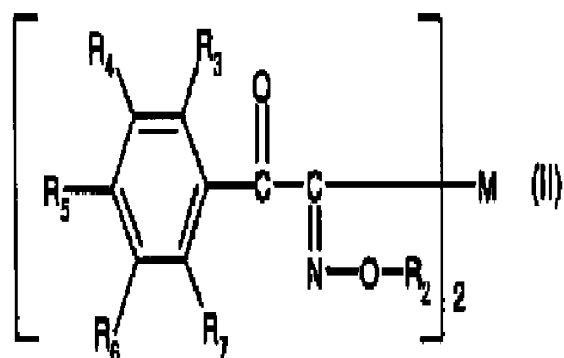
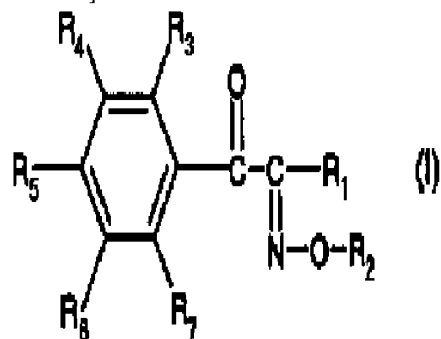
An object of this invention is to provide the photosensitive paste composition in which the outstanding photo-curing depth is shown in addition to the above-mentioned characteristic. Furthermore, an object of this invention is to

provide the panel in which the baked material pattern of the request of a flat-panel display was formed, using the above-mentioned photosensitive paste composition.

[0012]

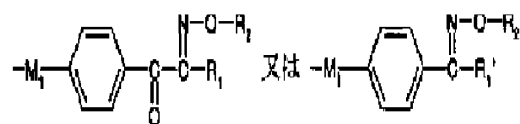
[Means for Solving the Problem] In order to attain said purpose, according to this invention, as (A) inorganic matter particles, an organic component containing (B) photopolymerization nature compound, and a (C) photopolymerization initiator, A photosensitive paste composition containing at least one sort of compounds expressed with following formula (I), (II), (III), or (IV) is provided.

[Formula 5]

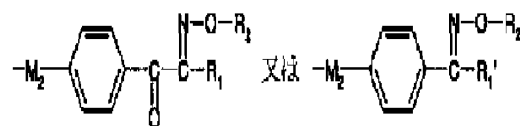


(The inside of a formula and R_1 are phenyl (this).) Whether it is unsubstituted, C1 or - C6 alkyl, phenyl, halogen, OR_8 , it is replaced by one or more of SR_9 or $NR_{10}R_{11}$ -- it is -- or --; or R_1 , C1 - C20 alkyl or C2 - C20 alkyl (this) one or more of -O- are interrupted by a case, and/or it is replaced by one or more of the hydroxy group by the case -- it is -- or --; or R_1 , It is C5 - C8 cycloalkyl or C2 - C20 alkanoyl, or is benzoyl (this). Whether it is unsubstituted, C1 or - C6 alkyl, phenyl, OR_8 , it is replaced by one or more of SR_9 or $NR_{10}R_{11}$ -- it is -- or --; or R_1 , C2 - C12 alkoxy carbonyl (this) one or more of -O- are interrupted by a case, and/or it is replaced by one or more of the hydroxy group by the case -- it is -- or --; or R_1 -- phenoxycarbonyl (whether this is unsubstituted, C1 or - C6 alkyl, halogen, and phenyl.) it is replaced by one or more of OR_8 or $NR_{10}R_{11}$ -- it is -- or --; or R_1 , - $CONR_{10}R_{11}$, CN, NO_2 , C1 - C4 halo alkyl, $S(O)_m$ - replaced by $S(O)_m$ - (C1 - C6 alkyl), unsubstituted or C1 - C12 alkyl (C6 - C12 aryl), Or are SO_2O - (C1 - C6 alkyl), SO_2O - (C6 - C10 aryl), or a diphenyl-phosphinoyl, and; m , It is 1 or 2 and; R_1' is C2 - C12 alkoxy carbonyl (this). one or more of -O- are interrupted by a case, and/or it is replaced by one or more of hydroxyl by the case -- it is -- or --; or R_1' , phenoxycarbonyl (whether this is unsubstituted, and C1-C -- 6 alkyl) it is replaced by one or more of halogen, phenyl, OR_8 , or $NR_{10}R_{11}$ -- it is -- or --; or R_1' -- C5 - C8 cycloalkyl, - $CONR_{10}R_{11}$, CN, or phenyl (this) It is replaced by SR_9 and by a case here Basis R_4' , . 5- or 6-membered-ring is formed via basis R_9 by building the combination to the carbon atom of the phenyl ring which has R_5' and R_6' . Or if at least one of R_4' , R_5' , and R_6' is - SR_9 , R_1' , further -- C1 - C12 alkyl (whether this is unsubstituted and halogen.) It is replaced by one or more of OH, OR_2 , phenyl, halogenation phenyl, or SR_9 substituted phenyl, and -O- or -NH(CO)- is interrupted by the case -- it is --; R_2 , Are C2 - C12 alkanoyl (this is unsubstituted or is replaced by one or more of halogen or CN), or; or R_2 , or it is C4 - C6 ARUKE noil (however, conjugate of the double bond has not been carried out to a carbonyl group) --; or R_2 -- benzoyl (whether this is unsubstituted, C1 or - C6 alkyl, and halogen -- it CN(ing) and OR_8 (ing) and) it is replaced by one or more of SR_9 or $NR_{10}R_{11}$ -- it is -- or -- or R_2 , C2 - C6 alkoxy carbonyl; or phenoxycarbonyl (this) it is unsubstituted or is replaced by C1 - C6 alkyl or halogen -- it is --; R_3 , R_4 , R_5 , R_6 , and R_7 , They are hydrogen, halogen, C1 - C12 alkyl, cyclopentyl, cyclohexyl, or phenyl (this) independently mutually. it is unsubstituted or is replaced by one or more of OR_8 , SR_9 , or $NR_{10}R_{11}$ -- it is -- or --; or R , [$_3$ and] R_4 , R_5 , R_6 , and R_7 , Benzyl, benzoyl, C2 - C12 alkanoyl or C2 - C12 alkoxy carbonyl (this) one or more of -O- are interrupted by a case, and/or it is replaced by one or more of hydroxyl by the case -- it is -- or --; or R_3 , R_4 , R_5 , R_6 , and R_7 -- FENONIKISHI carbonyl -- or it basis- OR_8 (ing) and, SR_9 , SOR_9 , SO_2R_9 , or $NR_{10}R_{11}$ (here) Substituent OR_8 , SR_9 , and $NR_{10}R_{11}$, By a case, one of the further substituent of a phenyl ring, or the carbon atoms of a phenyl ring. 5- or 6-membered-ring is formed via basis R_8 , R_9 , R_{10} , and/or R_{11} -- it is -- although --; -- however, At least one of R_3 , R_4 , R_5 , R_6 , and the R_7 . Are OR_8 , SR_9 , and $NR_{10}R_{11}$ and; R_4' , R_5' , and R_6' , They are hydrogen, halogen, C1 - C12 alkyl,

cyclopentyl, cyclohexyl, or phenyl (this) independently mutually. or it is unsubstituted -- or OR₈ and SR₉ -- or -- or it is replaced by NR₁₀R₁₁ -- it is -- or --; or R₄'. R₅' and R₆' are benzyl, benzoyl, C2 - C12 alkanoyl or C2 - C12 alkoxy carbonyl (this). one or more of -O- are interrupted by a case, and/or it is replaced by one or more of hydroxyl by the case -- it is -- or --; or R₄'. R₅' and R₆' are FENONIKISHI carbonyl or basis OR₈, SR₉, SOR₉, SO₂R₉, or NR₁₀R₁₁ (here). Substituent OR₈, SR₉, and NR₁₀R₁₁, By a case, one of the further substituent of a phenyl ring, or the carbon atoms of a phenyl ring. 5- or 6-membered-ring is formed via basis R₈, R₉, R₁₀, and/or R₁₁ -- it is -- although --; -- however, At least one of R₄', R₅', and the R₆'. If it is OR₈, SR₉, and NR₁₀R₁₁, and; and R₅' are methoxy, both R₄' and R₆' are hydrogen simultaneously and R₁' is CN, R₂'. [whether benzoyl or not 4-(C1 - C10 alkyl) benzoyl but; R₈ is hydrogen, C1 - C12 alkyl, and] or C2 - C6 alkyl (C1-C4 alkoxy ** this -OH, -SH, and -CN.) C3 - C6 alkene oxy, -OCH₂CH₂ CN, -OCH₂CH₂ (CO) O (C1 - C4 alkyl), -O(CO)- (C1 - C4 alkyl) and - it is replaced by O(CO)-phenyl, - (CO) OH, or -(CO) O (C1 - C4 alkyl) -- it is -- or --; or R₈, Are C2 - C6 alkyl (this is interrupted more by one or more of -O-), or; or R₈, - (CH₂CH₂O)_nH, C2 - C8 alkanoyl, C3 - C12 alkenyl, C3 - C6 ARUKE noil, cyclohexyl, or phenyl (this) it is unsubstituted or is replaced by halogen, C1 - C12 alkyl or C1 - C4 ARUKOKISHI -- it is -- or --; or R₈ -- phenyl- (C1 - C3 alkyl), Si(C1 - C8 alkyl)_r(phenyl)_{3-r}, or following formula: [Formula 6]

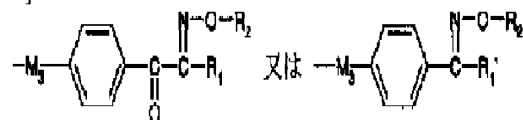


Are a basis of *****, and; n is 1-20, and; r, It is 1, 2, or 3 and; R₉ is hydrogen, C1 - C12 alkyl, C3 - C12 alkenyl, and cyclohexyl; C2 - C6 alkyl (this). - OH, -SH, -CN, C1 - C4 alkoxy ** C3 - C6 alkene oxy, -OCH₂CH₂CN and -OCH₂CH₂(CO) O (C1 - C4 alkyl), -O(CO)- (C1 - C4 alkyl) and - it is replaced by O(CO)-phenyl, -(CO) OH, or - (CO) O (C1 - C4 alkyl) -- it is -- or --; or R₉, Are C2 - C12 alkyl (this is interrupted by one or more of -O- or -S-), or; or R₉, It is phenyl (this is unsubstituted or is replaced by halogen, C1 - C12 alkyl or C1 - C4 ARUKOKISHI), or; or R₉ is phenyl- (C1 - C3 alkyl) or a following formula. : [Formula 7]



Are a basis of *****, and; R₁₀ and R₁₁, Independently mutually Hydrogen, C1 - C12 alkyl, C2 - C4 hydroxyalkyl, C2 - C10 alkoxy alkyl, C3 - C5 alkenyl, C5 - C12 cycloalkyl, phenyl- (C1 - C3 alkyl), or phenyl (this) it is unsubstituted or is replaced by C1 - C12 alkyl or C1 - C4 ARUKOKISHI -- it is -- or --; or R₁₀, and R₁₁, Are C2 - C3 alkanoyl, C3 - C6 ARUKE noil, or benzoyl, or; or R₁₀, and R₁₁, It becomes together and is C2 - C6 alkylene (this). -O- or -NR₈- is interrupted by a case, and/or by a case Hydroxyl, it is replaced by C1 - C4 alkoxy ** C2 - C4

alkanoloxy or benzyloxy one -- it is -- or -- a time of; or R_{10} being hydrogen -- R_{11} -- following formula: [Formula 8]



May be a basis of ***** and; M_1 C1 - C12 alkylene, cyclohexylene, Phenylene, -(CO) O-(C2 - C12 alkylene)-O (CO)-, -(CO) O-(CH₂CH₂O)_n-(CO)- or -(CO)-(C2 - C12-alkylene)- it is (CO)- and; M_1 , It is direct coupling or is C1 - C12 alkyleneoxy (this). by the case, 1-5 -O-, -S-, and/or -NR₁₀- are interrupted -- it is --; M_2 , It is direct coupling or they are; or (C1 - C12 alkylene)-S- (this) by the case, 1-5 -O-, -S-, and/or -NR₁₀- are interrupted -- it is --; M_3 , Direct coupling and piperazino group; or (C1 - C12 alkylene)-NH- (this) by the case, 1-5 -O-, -S-, and/or -NR₁₀- are interrupted -- it is -- although --; however (i) R_5 are methoxy and R_2 is benzoyl or acetyl -- if it becomes -- R_1 -- not phenyl but;

(ii) R_5 is methoxy and R_2 is ethoxycarbonyl -- if it becomes -- R_2 -- benzoyl or not ethoxycarbonyl but;

(iii) R_5 is methoxy and R_1 is 4-methoxy benzoyl -- if it becomes -- R_2 -- not ethoxycarbonyl but;

(iv) R_2 is not benzoyl, if R_5 is methacryloyl amino and R_1 is methyl;

(v) Both R_5 and R_4 or R_5 , and R_6 are OR₈ groups, those OR₈ groups become together, a ring is formed via R_8 , this gives -O-CH₂-O-, and R_1 is methyl -- if it becomes -- R_2 -- not acetyl but;

(vi) R_4 , R_5 , and R_6 are simultaneously methoxy, and R_1 is ethoxycarbonyl -- R_2 will not be acetyl if it becomes.

In this specification, C1 - C6 alkyl means an alkyl group of the carbon numbers 1-6 (the same about other similar expressions).

[0013]Furthermore, according to this invention, a panel of a flat-panel display which formed a baked material pattern of a request of a partition pattern, a derivative pattern, an electrode pattern, a black matrix pattern, etc. using the above photosensitive paste compositions is provided. The method is characterized by including a process calcinated after pattern formation with the lift-off method or the photolithographic method which used said photosensitive paste composition.

[0014]

[Embodiment of the Invention]The photosensitive paste composition concerning this invention is using as the main ingredients a lot of non-subtlety particle components and the organic component containing a photopolymerization nature compound, after it forms a pattern by the photo-curing of a photosensitive organic component, it calcinates, and it forms the baked material pattern of an inorganic substance. Problems which this invention persons described above, such as a photoresist and productivity, A lot of non-subtlety particle components in the included photosensitive paste composition as a (C) photopolymerization initiator, By adding at least one sort of O-acyl oxime system compounds expressed with following formula (I), (II), (III), or (IV), it finds out being improved substantially and comes to complete this invention. Namely, O-acyl oxime system compound used as a (C) photopolymerization initiator by this invention, It compares with the case where photopolymerization initiators generally used

conventionally, such as an acetophenone series, a benzophenone series, a benzoin system, and an amino ketone system, are used. It reacted to high sensitivity to the irradiated activity energy line, and the photopolymerization speed of the photopolymerization nature compound was large, therefore photo-curing depth became large, and it found out that definition improved. Therefore, the photoresist of a photosensitive paste composition improves substantially, photo-curing can fully advance until it results in the depths of the coat formed even if it was a thick film, and it is hard to produce the curvature in the case of calcination, and line width contraction, and a high aspect ratio and highly precise pattern processing become possible. Rather than the case where the photopolymerization initiator generally used conventionally is used in the case of the same thickness, a light exposure can be lessened and energy saving can be realized.

[0015]As mentioned above, although the photosensitive paste composition concerning this invention contains (A) inorganic matter particles, the organic component containing (B) photopolymerization nature compound, and the (C) O-acyl oxime system photopolymerization initiator as an essential ingredient, The contents of the above-mentioned (A) ingredient and the (B) ingredient change with desired baked material patterns, and change also with pattern formation methods. First, in formation of a partition pattern and a dielectric pattern, glass particles are used as inorganic particles of the aforementioned (A) ingredient, and when it is a black matrix pattern, glass particles and a black pigment are used. On the other hand, in electrode pattern formation, conductive powder (conductive metal powder or/and metallic oxide) is used, but in order to raise calcination nature so that it may mention later, when it is preferred to use together optimum dose of glass particles and it forms a black electrode pattern, a black pigment is also used further. In addition, according to a request, aggregate (inorganic filler) can be added to a photosensitive paste composition.

[0016]Next, the "organic component containing a photopolymerization nature compound" of the aforementioned (B) ingredient means that a photopolymerization nature ingredient is included as an essential ingredient. As a photopolymerization nature ingredient, a photosensitive binder (photosensitive prepolymer) besides photosensitive monomer, oligomer and/or polymer, and a carboxyl group (B-3) content photopolymer (oligomer or polymer) (B-1) which is mentioned later is mentioned. As arbitrary organic components, pasting of a constituent has a useful solvent and dispersing agent. When a dispersing agent is used, since it can paste, the advantage that it can form in a solventless type paste is acquired easily, without using an organic solvent. As other arbitrary organic components, other photopolymerization initiators other than a binder and the aforementioned (C) ingredient, a photosensitizer, stabilizer, defoaming and a leveling agent, a silane coupling agent, an antioxidant, etc. are mentioned.

[0017]Since the developing process is unnecessary when adopting the lift-off method as a pattern formation method, it is not necessary to use what has a carboxyl group which is mentioned later as a photopolymerization nature ingredient or an organic binder. However, using the photopolymerization nature ingredient which has a carboxyl group, and an organic binder does not interfere at all. However, in adopting the photolithographic method as pattern formation and developing negatives by an alkaline aqueous solution moreover. One of management is needed for the photopolymer (oligomer or polymer) used as a photopolymerization nature ingredient, using an alkali solubility binder as an organic binder, using what has a carboxyl group.

[0018]Hereafter, each ingredient of the photosensitive paste composition of this invention is explained. What uses as the main ingredients what has glass transition point (T_g)300-500 ** and glass softening point (T_s)400-600 **, for example, lead oxide, bismuth oxide, a zinc oxide, or lithium oxide as glass particles in said inorganic particle (A) can use it conveniently. From a point of resolution, glass particles with a mean particle diameter of 10 micrometers or

less are preferred. When the total quantity of the ingredient under paste of those other than glass particles is made into 100 weight sections, the rate used as 50 to 2,000 weight section is suitable for the loadings of glass particles. [0019]As a desirable example of the glass particles used as the main ingredients, lead oxide, In PbO, by weight % of an oxide basis, B_2O_3 48 to 82% 0.5 to 22%, In SiO_2 , aluminum $_2O_3$ 3 to 32% 0 to 12%, BaO has 0 to 10%, in TiO_2 , Bi_2O_3 has [ZnO] 0 to 25% of presentation 0 to 2.5% 0 to 15%, and the amorphous fritto whose softening temperature is 420-590 ** is mentioned.

[0020]As a desirable example of the glass particles used as the main ingredients, bismuth oxide, Bi_2O_3 by weight % of an oxide basis 35 to 88%, 5 to 30%, aluminum $_2O_3$ has 0 to 5% 0 to 20%, BaO has 1 to 25%, ZnO has [B_2O_3] 1 to 20% of presentation in SiO_2 , and the amorphous fritto whose softening temperature is 420-590 ** is mentioned.

[0021]As a desirable example of the glass particles used as the main ingredients, a zinc oxide, In ZnO, by weight % of an oxide basis, K_2O 25 to 60% 2 to 15%, 25 to 45%, aluminum $_2O_3$ has 0 to 10% 1 to 7%, BaO has 0 to 20%, MgO has [B_2O_3] 0 to 10% of presentation in SiO_2 , and the amorphous fritto whose softening temperature is 420-590 ** is mentioned.

[0022]As a desirable example of the glass particles used as the main ingredients, lithium oxide, In Li_2O , by weight % of an oxide basis, Bi_2O_3 1 to 13% 0 to 30%, 1 to 50%, aluminum $_2O_3$ has 1 to 40% 1 to 50%, BaO has 1 to 20%, ZnO has [B_2O_3] 1 to 25% of presentation in SiO_2 , and the amorphous fritto whose softening temperature is 420-590 ** is mentioned.

[0023]As an inorganic filler in said inorganic particle (A), all the things that can contribute to the improvement in compactness inside baked material patterns, such as a septum, can use alumina, silica, zircon, titanium oxide, etc. That is, although a glass component is contracted at the time of calcination, contraction and internal compactness can be adjusted with the loadings of an inorganic filler. That is, baked material patterns, such as a septum whose contraction it is precise and is small, can be obtained by carrying out 0.1-50 weight-section combination of the inorganic filler per said glass-particles 100 weight section. Under the present circumstances, since the adhesive property over a substrate comes to be inferior when the loadings of an inorganic filler become more superfluous than a mentioned range, it is not desirable.

[0024]As a black pigment in said inorganic particle (A), when a baked material pattern is asked for black, it is used, and the black pigment which consists of one sort or two kinds or more of metallic oxides, such as Fe, Co, nickel, Cu, Mn, and aluminum, can be added. As loadings of a black pigment, ten to 100 weight section is suitable per said glass-particles 100 weight section.

[0025]As the conductive metal powder in said inorganic particle (A), or a metallic oxide, If resistivity is the conductive powder below 1×10^{-3} omega-cm, it can use broadly, Silver (Ag), gold (Au), nickel (nickel), copper (Cu), aluminum (aluminum), Tin (Sn), lead (Pb), zinc (Zn), iron (Fe), platinum (Pt), Iridium (Ir), osmium (Os), palladium (Pd), rhodium (Rh), Simple substances, such as a ruthenium (Ru), tungsten (W), and molybdenum (Mo), the alloy of those, etc. Tin oxide (SnO_2), indium oxide (In_2O_3), ITO (Indium Tin Oxide), ruthenium oxide (RuO_2), etc. can be used. These can be used as independent or two sorts or more of mixed powder.

[0026]As for the shape of the above-mentioned conductive metal powder or a metallic oxide, although it can use

various things, such as a globular shape, the shape of a flake, and the shape of a dendrite, when an optical characteristic and dispersibility are taken into consideration, it is preferred to use a spherical thing. As mean particle diameter, it is preferred from a point of resolution a thing of 20 micrometers or less and to use a thing of 5 micrometers or less preferably. About Ag, nickel, and especially aluminum, it is preferred to perform processing by fatty acid because of stabilization of antioxidizing of conductive metal powder, the improvement in dispersibility within a constituent, and development nature. As fatty acid, oleic acid, linolic acid, linolenic acid, stearic acid, etc. are mentioned.

[0027]When the total quantity of the ingredient under paste of those other than conductive metal powder or a metallic oxide is made into 100 weight sections, the rate used as 50 to 2,000 weight section is suitable for the loadings of conductive metal powder or a metallic oxide. If it becomes easy to produce line width contraction and an open circuit of a conductor circuit and blends so much on the other hand exceeding 2,000 weight sections when the loadings of conductive metal powder or a metallic oxide are less than 50 weight sections, the penetration of light will be spoiled and sufficient photoresist of a constituent will become is hard to be obtained. Furthermore, glass particles which were described above for the improvement in adhesion to the intensity of the coat after calcination and a substrate can be added at a rate of one to 30 weight section per metal-powder 100 weight section.

[0028]As an organic component (B) containing a photopolymerization nature compound, (B-1) The photosensitive monomer which has at least one acrylyl group (meta) in one molecule, Oligomer or polymer of the weight average molecular weight 1,000-100,000 and the acid value 20 - 150 mgKOH/g which have oligomer and/or polymer, and a carboxyl group (B-2), (B-3) The weight average molecular weight 1,000-100,000, the acid value 20 - 150 mgKOH/g which have a carboxyl group and an ethylene nature unsaturation group, And an organic component [like oligomer of 350-2,000, or polymer] etc. in which the double bond equivalent is. A binder, a photopolymerization initiator, a photosensitizer, an organic solvent, stabilizer, a silicone series, and acrylic defoaming and leveling agent, These can be arbitrarily chosen if needed for the photo-curing pattern formation method made into the purpose including the organic component under paste like a silane coupling agent and an antioxidant.

[0029]As a typical example of the photosensitive monomer which has at least one acrylyl group (meta) in the aforementioned (B-1) one molecule, oligomer, and/or polymer, Hydroxyalkyl (meta) acrylate, such as 2-hydroxyethyl (meta) acrylate and 2-hydroxypropyl (meta) acrylate; Ethylene glycol, Mono- ** of glycols, such as methoxy tetraethylene glycol and a polyethylene glycol, di(meth)acrylate;N, Acrylamide (meta);N, such as N-dimethyl(meta) acrylamide and N-methylol(metha)acrylamide, Amino alkyl (meta) acrylate, such as N-dimethylaminoethyl (meta) acrylate; Hexandiol, Trimethylolpropane, pentaerythritol, ditrimethylol propane, The multivalent (meta) acrylate of polyhydric alcohol, such as dipentaerythritol and tris hydroxyethyl isocyanurate, these ethyleneoxide additions, or a propylene oxide addition; Phenoxyethyl (meta) acrylate, The acrylate (meta) of the ethyleneoxide addition of phenols, such as poly ETOKISHIJI (meta) acrylate of bisphenol A, or a propylene oxide addition; Glycerin diglycidyl ether, Acrylate [of glycidyl ether, such as trimethylolpropane triglycidyl ether and triglycidyl isocyanurate,] (meta); and melamine (meta) acrylate, and urethane (meta) acrylate are mentioned. in this detailed in the letter one, acrylate (meta-) is a term which names generically acrylate, methacrylate, and those mixtures, and it is the same about other similar expressions.

[0030]The above (B-2) and oligomer of (B-3), or polymer is a carboxyl group content photopolymer in which resin having carboxyl groups and itself which do not have an ethylene nature unsaturated double bond have an ethylene nature unsaturated double bond. The following is mentioned as resin (any of oligomer and polymer may be

sufficient) which can be used conveniently.

(1) to the copolymer of (a) unsaturated carboxylic acid and the compound which has the (b) unsaturated double bond. The ethylene nature unsaturated compound which has a functional group reacted to a carboxyl group is made to react, To the copolymer of the carboxyl group content photopolymer (2) which used the ethylene nature unsaturation group as the pendant, the (c) epoxy group, the compound which has an unsaturated double bond, and the compound which has the (b) unsaturated double bond. (a) To the copolymer of the acid anhydride which has a carboxyl group content photopolymer (3) which makes unsaturated carboxylic acid react, makes the (d) polybasic acid anhydride react to the generated hydroxyl group of the 2nd class, and is obtained, and the (e) unsaturated double bond, and the compound which has the (b) unsaturated double bond. (f) Make (h) unsaturation monocarboxylic acid react to the carboxyl group content photopolymer (4) produced by making the compound which has an unsaturated double bond react to a hydroxyl group, and the (g) epoxy compound, To the epoxy group of a compound and the copolymer of glycidyl (meta) acrylate which has a carboxyl group content photopolymer (5) produced by making the (d) polybasic acid anhydride react to the generated hydroxyl group of the 2nd class, and the (b) unsaturated double bond. (i) Make the organic acid which has one carboxyl group and does not have an ethylene nature unsaturated bond in one molecule react, To the generated hydroxyl group of the 2nd class, the (d) polybasic acid anhydride. To resin having carboxyl groups produced by making the (d) polybasic acid anhydride react to the resin having carboxyl groups (7) (j) hydroxyl group content polymer produced by making the (d) polybasic acid anhydride react to the resin having carboxyl groups (6) (j) hydroxyl group content polymer produced by making react. (c) The carboxyl group content photopolymer produced by making the compound which has an unsaturated double bond react to an epoxy group further [0031]As an example of the carboxyl group content photopolymer of the above (1), to a part of carboxyl group of the copolymer of unsaturated carboxylic acid (a) and the compound (b) which has an unsaturated double bond. It is a rate which raises a photoresist even to such an extent that sufficient photo-curing depth is obtained, and for example, glycidyl (meta) acrylate is made to react, and there is resin which introduced the unsaturated double bond of this glycidyl (meta) acrylate into the side chain. Since a part of carboxyl group which the unsaturated carboxylic acid (a) which is one monomer component of the above-mentioned copolymer has remains while it has been unreacted, the carboxyl group content photopolymer obtained is fusibility to an alkaline aqueous solution. Therefore, the development stable by the alkaline aqueous solution after selective exposure of the coat formed from the photosensitive paste composition containing such resin is attained.

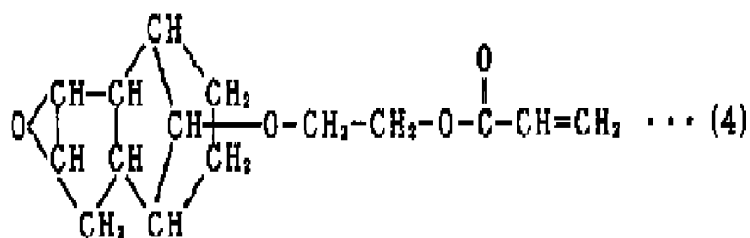
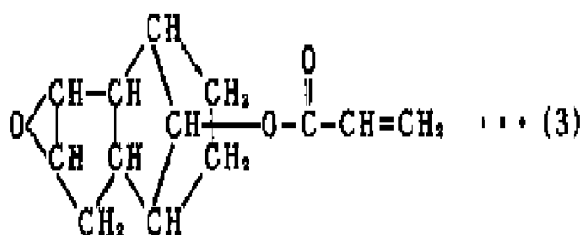
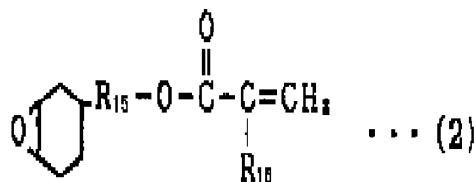
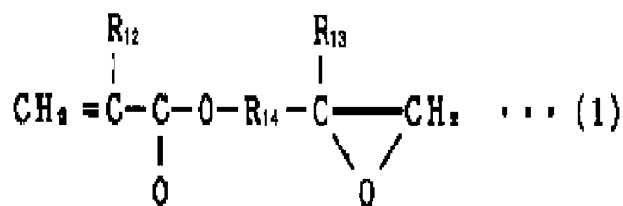
[0032]As a concrete example of said unsaturated carboxylic acid (a), To acrylic acid, methacrylic acid, itaconic acid, crotonic acid, maleic acid, fumaric acid, vinylacetic acid or these acid anhydrides, and a pan. An acid anhydride and 2-hydroxyethyl (meta) acrylate, such as a maleic anhydride, itaconic acid anhydride, and pyromellitic dianhydride, A resultant with the unsaturated compound which has hydroxyl groups, such as hydroxyalkyl (meta) acrylate, such as 2-hydroxypropyl (meta) acrylate, etc. are mentioned, and these can be used combining independent or two sorts or more. Acrylic acid and/or methacrylic acid are preferred also in these.

[0033]As an example of a compound (b) of having said unsaturated double bond, Styrene, chlorostyrene, alpha-methylstyrene; As a substituent, methyl, Ethyl, n-propyl, isopropyl, n-butyl, isobutyl, tert-butyl, Amyl, 2-ethylhexyl, octyl, capryl lactam, nonyl, dodecyl, Hexadecyl, octadecyl, cyclohexyl, isobornyl, methoxy ethyl, Butoxyethyl, 2-hydroxyethyl, 2-hydroxypropyl, Mono- (meta) acrylate of an acrylate; polyethylene glycol or mono- (meta) acrylate of a polypropylene glycol which has 3-chloro-2-hydroxypropyl etc. (meta); Vinyl acetate, Butanoic acid vinyl, benzoic acid vinyl; Acrylamide, methacrylamide, N-hydroxymethylacrylamide, N-hydroxymethylmethacrylamide,

N-methoxymethyl acrylamide, N-ethoxymethyl acrylamide, N-butoxy methylacrylamide, acrylonitrile, vinyl ether, or isobutylene is mentioned, and these can be used combining independent or two sorts or more. Also in these compounds, preferably, styrene, alpha-methylstyrene, low-grade alkyl (meta) acrylate, and isobutylene are used, and a methylmetaacrylate is especially preferred from a point of the pyrolysis nature of resin.

[0034]As an ethylene nature unsaturation group added as a pendant, there are a vinyl group, an allyl group, an acrylyl group, a methacryloyl group, etc. The method of making such an ethylene nature unsaturation group giving said copolymer has a common method of carrying out the addition reaction of the ethylene nature unsaturated compound which has an epoxy group, or the acrylic acid (meta) chloride to the carboxyl group of a copolymer. As the ethylene nature unsaturated compound and acrylic acid (meta) chloride which have an epoxy group here, Glycidyl (meta) acrylate, allyl glycidyl ether, alpha-methyl glycidyl (meta) acrylate, alpha-ethyl glycidyl (meta) acrylate, crotonic acid glycidyl ether, isocrotonic acid glycidyl ether, acrylic acid (meta) chloride, an allyl chloride (meta), the compound shown by following general formula (1) - (4), etc. are mentioned. Glycidyl (meta) acrylate is preferred also in these.

[Formula 9]



(式中、 R_{12} 、 R_{13} 及び R_{16} はそれぞれ水素原子又はメチル基を表わし、 R_{14} は炭素数 1～12 の脂肪族炭化水素を表わし、 R_{15} は $-\text{CH}_3-$ 又は $-\text{CH}_2-\text{O}-\underset{\text{O}}{\parallel} \text{C}-(\text{CH}_2)_n-$ を表わす。)

$n=1\sim 6$

[0035]The carboxyl group content photopolymer of the above (2), (c) In order to raise a photoresist even to such an extent that sufficient photo-curing depth for the epoxy group of the copolymer of an epoxy group, the compound which has an unsaturated double bond, and the compound which has the aforementioned (b) unsaturated double bond is obtained in a molecule, Make the carboxyl group of the aforementioned (a) unsaturated carboxylic acid react, and the unsaturated double bond of this unsaturated carboxylic acid is introduced into a side chain, and it is the resin which carried out the esterification reaction of the (d) polybasic acid anhydride to the hydroxyl group of the 2nd class generated by the above-mentioned addition reaction, and introduced the carboxyl group into the side chain.

[0036]As an example of a compound (c) which contains an epoxy group and an unsaturated double bond in the above-mentioned molecule, Glycidyl (meta) acrylate, alpha-methyl glycidyl (meta) acrylate, a compound shown by said formula (1) - (4), etc. are mentioned, and these can be used combining independent or two sorts or more. On the

other hand, as an example of a polybasic acid anhydride (d), A succinic anhydride, a maleic anhydride, anhydrous adipic acid, phthalic anhydride, tetrahydro phthalic anhydride, Hexahydro phthalic anhydride, methylhexahydrophthalic anhydride, itaconic acid anhydride, methyl and methylene tetrahydro phthalic anhydride, trimellitic anhydride, pyromellitic dianhydride, etc. are mentioned, and these can be used combining independent or two sorts or more.

[0037]A carboxyl group content photopolymer of the above (3), (e) In order to raise a photoresist even to such an extent that sufficient photo-curing depth for a part of acid anhydride group of a copolymer of an acid anhydride which has an unsaturated double bond, and a compound which has the aforementioned (b) unsaturated double bond is obtained, (f) It is the resin which made a hydroxyl group and a hydroxyl group of a compound which has an unsaturated double bond react, considered it as half ester, and introduced an unsaturated double bond of this compound (f) into a side chain.

[0038]As a concrete example of an acid anhydride (e) which has said unsaturated double bond, A maleic anhydride, itaconic acid anhydride and also pyromellitic dianhydride, and 2-hydroxyethyl (meta) acrylate, A partial resultant with an unsaturated compound which has hydroxyl groups, such as hydroxyalkyl (meta) acrylate, such as 2-hydroxypropyl (meta) acrylate, etc. are mentioned, and these can be used combining independent or two sorts or more. A maleic anhydride which is stabilized and can compound polymer also in these is preferred.

[0039]As an example of a hydroxyl group and a compound (f) which has an unsaturated double bond, Hydroxyalkyl (meta) acrylate, such as 2-hydroxyethyl (meta) acrylate and 2-hydroxypropyl (meta) acrylate; Lactone denaturation hydroxyethyl (meta) acrylate etc. are mentioned, These can be used combining independent or two sorts or more. Carboxyl group content photopolymer (1) which was described above - (3) is excellent in a photoresist and calcination nature, and it contributes to the preservation stability of a constituent.

[0040]A carboxyl group content photopolymer of the above (4), (g) In order to raise a photoresist even to such an extent that sufficient photo-curing depth for an epoxy group of an epoxy compound is obtained, (h) Make a carboxyl group of unsaturation monocarboxylic acid react, make epoxy acrylate generate, and it is the resin which carried out the esterification reaction of the aforementioned (d) polybasic acid anhydride to a hydroxyl group of the 2nd class generated by the above-mentioned addition reaction, and introduced a carboxyl group into a side chain. Such a carboxyl group content photopolymer is excellent in a photoresist, and epoxy acrylate of backbone polymer shows hydrophobicity. Therefore, when a photosensitive paste composition containing this resin is used, the hydrophobicity of epoxy acrylate is used advantageously and the development-proof nature of the pattern depths which cannot carry out photo-curing easily improves. As a result, the degree of margin of conditioning in development and an exposure process spreads, a yield at the time of mass production can be improved, and curl generating of pattern edge after calcination can be reduced substantially, and a high aspect ratio and a high definition pattern can be formed. Acrylic copolymerization resin which is easy to depolymerize with heat at the time of calcination can be mixed with the above-mentioned carboxyl group content photopolymer, and double bond concentration in all the resin which lowers and uses sintering temperature of a photosensitive paste composition by it can also be adjusted.

[0041]As said epoxy compound (g), although it is usable in all the epoxy resins, As a typical example, a bisphenol A type, a hydrogenation bisphenol A type, A bisphenol female mold, a bisphenol smooth S form, a phenol novolac type, A cresolnovolak type, a novolac type of bisphenol A, a biphenol type, As an epoxy compound of publicly known common use of a BIKISHIRE Norian type, N-glycidyl type, etc., and what is preferred as a commercial item, die cell company make EHPE-3150 grade is mentioned, and these can be used combining independent or two sorts

or more.

[0042]As an example of said unsaturation monocarboxylic acid (h), acrylic acid, methacrylic acid, crotonic acid, cinnamic acid, alpha-cyanocinnamic acid, beta-styryl acrylic acid, beta-furfuryl acrylic acid, etc. are mentioned, and these can be used combining independent or two sorts or more.

[0043]It is preferred that a number of equivalent of the number of equivalent/carboxyl group of an epoxy group performs a reaction of said epoxy compound (g) and unsaturation monocarboxylic acid (h) at 0.8-1.2, and a rate preferably set to 0.9-1.05. In order that unsaturation monocarboxylic acid may remain, when there is a problem of a bad smell and the above-mentioned number of equivalent exceeds 1.2 on the other hand, in order that many epoxy groups may remain, since it becomes easy to gel a number of equivalent of the number of equivalent/carboxyl group of an epoxy group in a stage of making a polybasic acid anhydride reacting, it is not preferred at less than 0.8. A reaction ratio of a polybasic acid anhydride to a generated hydroxyl group of the 2nd class is adjusted so that acid value of resin obtained eventually may become within the limits of 30 - 160 mgKOH/g preferably. Generally, the equivalent of a polybasic acid anhydride is 0.5 or more preferably 0.3 or more to 1 Eq of hydroxyl groups generated at a reaction of an epoxy compound and unsaturation monocarboxylic acid.

[0044]Resin having carboxyl groups of the above (5) has the aforementioned (b) unsaturated double bond, A compound and glycidyl (meta) acrylate, such as alkyl (meta) acrylate and substitution without neither a hydroxyl group nor an acidic group, or unsubstituted styrene, to a glycidyl group of a copolymer used as a main chain. (i) It is resin which makes organic acid which has one carboxyl group and does not have an ethylene nature unsaturated bond in one molecule react, makes carry out the addition reaction of the aforementioned (d) polybasic acid anhydride to a generated OH radical of the 2nd class, and is obtained. Introduction of a carboxyl group in this resin is generated by making organic acid react to an epoxy group of a pendant of the above-mentioned copolymer, And since it is what is performed by carrying out the addition reaction of the polybasic acid anhydride to a hydroxyl group of the 2nd class located near the main chain, a carboxyl group is combined with a main chain near part of a side chain, and basic glass particles and contact with conductive metal powder are controlled by a three-dimensional obstacle of a main chain and a side chain. As a result, a constituent which contains resin having carboxyl groups of such alkali solubility with glass particles and conductive metal powder shows outstanding preservation stability, and does not almost have producing change and gelling of viscosity during preservation.

[0045]As organic acid (i) which has one carboxyl group and does not have an ethylene nature unsaturated double bond in said one molecule, Acetic acid, propionic acid, n-butanoic acid, isobutyric acid, n-dimethylbutanoic acid, ethylbutanoic acid, Hexanoic acid, 2-methylpentanoic acid, 2-ethylpentanoic acid, heptanoic acid, 2-methylheptanoic acid, lauric acid, stearic acid, n-heptadecanoic acid, etc., Alkyl carboxylic acid, substitution, or unsubstituted benzoic acid of the carbon numbers 2-17, Aromatic group content alkyl carboxylic acid, such as (R) (S)-2-phenylpropionic acid, (R)-phenylisopropionic acid, 2-phenylbutyric acid, and 4-phenylbutyric acid, etc. are mentioned, and these can be used combining independent or two sorts or more.

[0046]Resin having carboxyl groups of the above (6) is the resin which made the comparatively weak aforementioned (d) polybasic acid anhydride of acidity react to (j) hydroxyl group content polymer, and introduced a carboxyl group. Since such resin having carboxyl groups contains a hydrophilic radical (a carboxyl group, a hydroxyl group), Good wettability to a substrate is shown, and a pyrolysis is easily carried out in an elevated temperature, and in each process of desiccation, exposure, development, and calcination, a photosensitive paste composition containing this shows stable adhesion and good preservation stability over a substrate, and, moreover, is

excellent also in calcination nature.

[0047]On the other hand, a carboxyl group content photopolymer of the above (7), It is a rate which raises a photoresist even to such an extent that sufficient photo-curing depth for a carboxyl group of said resin having carboxyl groups (6) is obtained, and it is the resin which made the aforementioned (c) epoxy group and an epoxy group of a compound which has an unsaturated double bond react, and introduced an unsaturated double bond of this compound (c) into a side chain. Such a carboxyl group content photopolymer is excellent in a photoresist, and even if it is blended with a lot of non-subtlety particle components and constitutes a paste composition, it shows sufficient photo-curing depth. It excels in calcination nature and contributes to improvement in preservation stability of a constituent.

[0048]As said hydroxyl group content polymer (j), olefin system hydroxyl group content polymer, acrylic polyol, rubber system polyol, polyvinyl-acetal system resin, styrene allyl alcohol system resin, cellulose type resin, etc. can be used. As olefin system hydroxyl group content polymer, polyethylene, polypropylene, polybutadiene, etc. can be used as a main chain, and resin which has a hydroxyl group in a main chain or a side chain can be used, and copolymer of allyl alcohol, ethylene, or butadiene, etc. can be used.

[0049]As an example of acrylic polyol, LR2507 by Mitsubishi Rayon Co., Ltd., LR2516, LR257, LR989, LR2536, LR532, LR598, LR566, LR286, LR511, and LR2528 grade are mentioned, As an example of rubber system polyol. They are mentioned by the uni-stole P901 made from ***** Petrochemistry, Kula Plane LIR-506 by Kuraray Co., Ltd., tangent line-20, TH-1, TH-21, TH-31, KURAPORU P-510, KURAPORU P-15610, and KURAPORU P-5010 grade, and again, As an example of styrene allyl alcohol resin, RJ100 by Monsanto Co., RJ101, ARCO Chemical 100 [SAA], and SAA101 grade are mentioned.

[0050]As polyvinyl-acetal system resin, a polyvinyl butyral, a polyvinyl acetal, A polyvinyl formal etc. can be used and S lek BMS by Sekisui Chemical Co., Ltd., the S lek BLS, the S lek BHS, the S lek BLSH, the S lek BMSH, etc. are mentioned.

[0051]As cellulose type resin, an acetyl cellulose and a nitrocellulose which esterified some hydroxyl groups of cellulose and cellulose are begun, and cellulose ester of acid, such as propionic acid, butanoic acid, phosphoric acid, sulfuric acid, and phthalic acid, is mentioned. Mixed ester which mixed acid can be used. Furthermore, methyl cellulose, ethyl cellulose, benzyl cellulose, carboxymethyl cellulose, etc. which etherified some hydroxyl groups of cellulose are mentioned as cellulose ether.

[0052]As hydroxyl group content polymer (j) to be used, although it is usable in any polymer other than the above, a thing of 50 - 250 mgKOH/g has a preferred hydroxyl value. Hydroxypropylmethylcellulose phthalate by Shin-Etsu Chemical Co., Ltd., Hydroxypropylmethylcellulose acetate succinate, cellulose acetate hexahydro phthalate, Hydroxypropylmethylcellulose acetate phthalate, hydroxypropylmethylcellulose hexahydro phthalate, etc. can be used as resin having carboxyl groups (6) as it is.

[0053]As the above-mentioned carboxyl group content photopolymer and resin having carboxyl groups, respectively -- the weight average molecular weight 1,000-100,000 -- desirable -- 5,000-50,000, and acid value -- 20 to 150 mgKOH/g, having 40 - 100 mgKOH/g preferably -- and a case of a carboxyl group content photopolymer -- the double bond equivalent -- 350-2,000 -- a thing of 400-1,500 can be used conveniently preferably. When a molecular weight of the above-mentioned resin is lower than 1,000, since it has an adverse effect on the adhesion of a coat at the time of development, and it is easy to produce poor development on the other hand when higher than 100,000, it is not desirable. When acid value is lower than 20 mgKOH/g, solubility over an alkaline aqueous solution is

insufficient, and since it is easy to produce poor development, and degradation of the adhesion of a coat and the dissolution of a photo-curing part (exposure part) arise on the other hand at the time of development when higher than 150 mgKOH/g, it is not desirable. When the double bond equivalent of a photopolymer is smaller than 350, on the other hand, residue remains easily at the time of calcination, and when larger than 2,000, since a high exposure is needed at the time of photo-curing, it is not desirable [the degree of job allowance at the time of development is narrow, and].

[0054]a photosensitive monomer which has said acrylyl group (B-1) (meta-) which was carried out. It is preferred independent or that in any case oligomer and/or polymer, resin having carboxyl groups (B-2), and (B-3) a carboxyl group content photopolymer blend these in total at 0 to 50% of the weight of a rate of the constituent whole quantity although it may mix and use. As for especially the above-mentioned (B-1) ingredient and (B-3) an ingredient, it is preferred that the constituent whole quantity blends 5% of the weight or more in total. When there are too few loadings of these photosensitive components than a mentioned range, sufficient photoresist and photo-curing depth are hard to be obtained, and pattern NINGU by selective exposure and development becomes difficult. On the other hand, if too more than a mentioned range, since a pattern at the time of calcination will get twisted and it will become easy to produce ***** contraction, it is not desirable.

[0055]As a binder in an organic component (B) containing a photopolymerization nature compound, any of a thing which has photosensitivity, or a thing which have and is not may be sufficient as itself for the purpose of raising stability and coating operability of a paste. however, when neither a photosensitive monomer which has said acrylyl group (meta-(B-1)) carried out nor oligomer nor polymer nor a carboxyl group content photopolymer is used, it is preferred to use a photosensitive binder. As a photosensitive binder, various, conventionally publicly known photopolymers (photosensitive prepolymer) which have photosensitive groups, such as ethylene nature unsaturated bonds, such as a vinyl group, an allyl group, an acrylyl group, and a methacryloyl group, and a propargyl group, can be used. On the other hand as a binder which does not have photosensitivity, The hydroxyl group content polymer (j) and lactone conversion polymer which added lactone to these hydroxyl groups or amino groups, A homopolymer of a lactone conversion monomer which added lactone to a hydroxyl group or an amino group of a monomer which has a hydroxyl group or an amino group, and an unsaturation group in one molecule, a copolymer of this lactone conversion monomer and a monomer which has other unsaturation groups, etc. are mentioned.

[0056]Next, a photopolymerization initiator (C) expressed with said general formula (I), (II), (III), or (IV) is O-acyl oxime system compound, and the following compounds are mentioned as the example. 1 -(4-phenylsulfanilphenyl)-Butane-1,2-dione 2-oxime O-benzoate, 1 -(4-phenylsulfanilphenyl)- Octane-1,2-dione 2-oxime O-benzoate, 1 -(4-phenylsulfanilphenyl)- Octan-1-one oxime O-acetate, 1 -(4-phenylsulfanilphenyl)- Butan-1-one oxime O-acetate, especially 1 -(4-phenylsulfanilphenyl)- Octane-1,2-dione It is 2-oxime O-benzoate. [0057]These O-acyl oxime system photopolymerization initiators (C) may be used independently, and may be used combining two or more sorts. 0.01 - 20 weight section is usually suitable for loadings of the above-mentioned O-acyl oxime system photopolymerization initiator (C) per sensitization ingredient 100 weight section under paste. In being less than 0.01 weight sections, in being more than 20 weight sections, on the other hand in [increase / a radical yield / too much / extremely] a process of photo-curing (exposure), it becomes easy for hardening not to fully advance, but to produce hardening unevenness.

[0058]In a photosensitive paste composition of this invention, the above-mentioned O-acyl oxime system photopolymerization initiator (C) can be conventionally combined with one sort of a publicly known

photopolymerization initiator, or two sorts or more, or can be further used combining a photosensitizer. By it, as compared with a case where each photopolymerization initiator is used independently, sensitivity and photo-curing depth become still larger, and definition improves. As an example of a typical thing of a publicly known photopolymerization initiator, conventionally, Benzoin, benzoin methyl ether, benzoin ethyl ether, Benzoin and benzoin alkyl ether, such as benzoin iso-propyl ether, An acetophenone, a 2,2-dimethoxy- 2-phenylacetophenone, Acetophenones, such as a 2,2-diethoxy- 2-phenylacetophenone and an 1,1-dichloroacetophenone. 2-methyl-1-[4-(methylthio) phenyl]-2-morpholinopropane 1-one, 2-benzyl-2-dimethylamino 1 -(4-morpholinophenyl)- The aminoacetophenones of butanone-1 grade. 2-methylantraquinone, 2-ethylantraquinone, 2-tert-butylantraquinone, Anthraquinone, such as 1-chloroanthraquinone, a 2,4-dimethyl thioxan ton, Benzophenones, such as ketals, such as thioxan tons, such as 2,4-diethylthio xanthone, 2-chloro thioxan ton, and a 2,4-diisopropyl thioxan ton, acetophenone dimethyl ketal, and benzyl dimethyl ketal, and benzophenone, or xanthenes. Bis(2,4,6-trimethyl benzoyl)-phenyl phosphine oxide, 2,4,6-trimethyl benzoyldiphenyl phosphine oxide, Bis(2,6-dimethoxybenzoyl)-2,4,4-trimethyl pentyl phosphine oxide, Phosphine oxide or screw acyl phosphine oxide, such as 2,4,6-trimethyl benzoylphenyl phosphinate, Various peroxide, dimethyl titanocene, diphenyl titanocene, Various titanocene system photopolymerization initiators, such as bis(pentafluorophenyl)titanocene and bis(eta⁵-cyclopentadienyl)-bis(2,6-difluoro-3-(1H-****- 1-yl) phenyl)titanium. Ferro SENIUMU salt system initiators, aluminate complex system initiators, and halogen system initiators. Screw imidazole series initiators, hyperoxidation ester system initiators, and ketocoumarin initiators. Acridine series initiators are mentioned and as an example of representation of a photosensitizer Leuco dye, N,N-dimethylaminobenzoic acid ethyl ester, N,N-dimethylamino isoamyl benzoate ester, pentyl-4-dimethylamino benzoate, The third class amines, such as triethylamine and triethanolamine, etc. are mentioned. 20 or less weight sections per photosensitive component 100 weight section under paste of 0.1 to 20 weight sections are preferably suitable for loadings (a case of combination with a photosensitizer total quantity) of these photopolymerization initiators.

[0059]In order that paste a photosensitive paste composition of this invention by diluting a constituent, and it makes an application process possible easily, it may subsequently be made to dry, and it may carry out film formation and may enable contact exposure, it can blend a proper quantity of an organic solvent. Specifically Ketone; toluene, such as methyl ethyl ketone and cyclohexanone, Aromatic hydrocarbon, such as xylene and tetramethyl benzene; Cellosolve, Methyl cellosolve, carbitol, methylcarbitol, butylcarbitol, Propylene glycol monomethyl ether, dipropylene glycol monomethyl ether, Glycol ether, such as dipropylene glycol monoethyl ether and triethylene glycol monoethyl ether; Ethyl acetate, Butyl acetate, a cellosolve acetate, butyl-cellosolve acetate, Acetate ester, such as carbitol acetate, butylcarbitol acetate, and propylene-glycol-monomethyl-ether acetate; Ethanol, Alcohols, such as propanol, ethylene glycol, and propylene glycol; Octane, Aliphatic hydrocarbon, such as Deccan; petroleum solvents, such as petroleum ether, petroleum naphtha, hydrogenation petroleum naphtha, and solvent naphtha, are mentioned, and it can use combining independent or two sorts or more.

[0060]The photosensitive paste composition of this invention can add a compound with effects, such as complex-izing with metal which is an ingredient of glass particles or conductive metal powder, or oxide powder, or salt formation, for improvement in preservation stability of a constituent. Specifically, acid, such as inorganic acid, organic acid, and a phosphoric acid compound (inorganic phosphoric acid, organic phosphorus acid), is mentioned. As for such stabilizer, it is preferably preferred to add at a rate of 0.1 - 5 weight section five or less weight sections per said inorganic particle (A) 100 weight section. As inorganic acid, nitric acid, sulfuric acid, chloride, boric acid,

etc. are mentioned. As organic acid, formic acid, acetic acid, acetoacetic acid, citrate, isocitric acid, Anisic acid, propionic acid, butanoic acid, isobutyric acid, a valeric acid, isovaleric acid, azelaic acid, Caproic acid, isocaproic acid, enanthic acid, caprylic acid, pelargonic acid, Undecanoic acid, lauryl acid, tridecanoic acid, myristic acid, pulmitic acid, Stearic acid, arachin acid, behenic acid (behenic acid), oxalic acid, malonic acid, Ethylmalonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid, Pyruvic acid, piperonyl acid, pyromellitic acid, suberic acid, azelaic acid, Sebacic acid, maleic acid, fumaric acid, phthalic acid, isophthalic acid, terephthalic acid, Tartaric acid, levulinic acid, lactic acid, benzoic acid, isopropylbenzoic acid, salicylic acid, Isocaproic acid, crotonic acid, isocrotonic acid, acrylic acid, methacrylic acid, Tiglic acid, ethylacrylic acid, ethylidenepropionic acid, dimethylacrylic acid, SHITORONERU acid, undecenoic acid, undecanoic acid, oleic acid, elaidic acid, erucic acid, brassidic acid, phenylacetic acid, cinnamic acid, methylcinnamic acid, naphthoic acid, abietic acid, acetylene dicarboxylic acid, atrolactinic acid, itaconic acid, crotonic acid, Sorbic acid, vanillic acid, pulmitic acid, hydroxycinnamic acid, hydroxynaphthoic acid, Hydroxybutyric acid, biphenyl dicarboxylic acid, phenylcinnamic acid, phenylacetic acid, Phenylpropionic acid, phenoxyacetic acid, propionic acid, hexanoic acid, Heptanoic acid, veratric acid, benzilic acid, oxalosuccinic acid, oxaloacetic acid, octanoic acid, gallic acid, mandelic acid, mesaconic acid, methylmalonic acid, mellitic acid, lauric acid, recinoleic acid, linolic acid, malic acid, etc. are mentioned.

[0061]As inorganic phosphoric acid, phosphoric acid, phosphorous acid, hypophosphorous acid, orthophosphoric acid, diphosphoric acid, Tripoli phosphoric acid, phosphonic acid, etc. are mentioned. As organic phosphorus acid, phosphoric acid methyl, phosphoric acid ethyl, phosphoric acid propyl, Phosphoric acid butyl, phosphoric acid phenyl, phosphoric acid dimethyl, diester phosphate, Dibutyl phosphate, dipropyl phosphate, diphenyl phosphate, phosphoric acid isopropyl, Phosphoric acid diisopropyl, phosphoric acid n butyl, phosphorous acid methyl, phosphorous acid ethyl, Phosphorous acid propyl, phosphorous acid butyl, phosphorous acid phenyl, dimethyl phosphite, Diethyl phosphite, phosphorous acid dibutyl, phosphorous acid dipropyl, diphenyl phosphite, Phosphorous acid isopropyl, phosphorous acid diisopropyl, phosphorous acid n butyl-2-ethylhexyl, Hydroxy ECHIRI range phosphonic acid, adenosine triphosphate, adenosine phosphate, Mono- (2-methacryloiloxy-ethyl) acid phosphate, mono- (2-acryloyloxyethyl) acid phosphate, II (2-methacryloiloxy-ethyl) acid phosphate, II (2-acryloyloxyethyl) acid phosphate, Ethyldiethyl phosphonoacetate, ethyl acid phosphate, butyl acid phosphate, butyl pyrophosphate, butoxyethyl acid phosphate, 2-ethylhexyl acid phosphate, Oleyl acid phosphate, tetracosyl acid phosphate, diethylene-glycol acid phosphate, methacrylate (2-hydroxyethyl) acid phosphate, etc. are mentioned.

[0062]As other acid, benzenesulfonic acid, toluenesulfonic acid, naphthalenesulfonic acid, Acid of sulfonic acid systems, such as ethane sulfonic acid, naphtholsulfonic acid, taurine, metanilic acid, sulfanilic acid, naphthylaminesulfonic acid, sulfobenzonic acid, and sulfamic acid, can also be used. Stabilizer which was enumerated above can be used combining independent or two sorts or more.

[0063]The photosensitive paste composition of this invention can also blend other additive agents, such as a silane coupling agent for improvement in adhesion of defoaming and leveling agents, such as a silicone series and acrylic, and a coat, if needed further. An antioxidant of publicly known common use for preventing oxidation of conductive metal powder and thermal polymerization inhibitor for raising thermal stability at the time of preservation can also be added further again if needed.

[0064]When a dispersing agent (D) used as a pasting agent in a constituent of this invention pastes a constituent, it is used in order to paste, even if it does not use an organic solvent, and makes possible a solventless type photosensitive paste composition, especially a solventless type photosensitive-glass-paste constituent. A compound and a high

molecular compound which have a polar group with glass particles, such as a carboxyl group, a hydroxyl group, and acid ester, and compatibility as a dispersing agent (D). For example, a salt etc. of acid content compounds, such as phosphoric ester, copolymer containing an acid radical, hydroxyl group content polycarboxylic acid ester, and long chain polyamino AMAIDO and acid ester can be used. As what can be especially used conveniently with a dispersing agent marketed, Disperbyk(registered trademark)-101, -103, -110, and -111 (all are the products made by big KEMI) are mentioned. Five or less weight sections per said inorganic particle (A) 100 weight section of 0.01 - 5 weight sections are preferably suitable for loadings of such a dispersing agent (D). When not blending a dispersing agent (D), since it will become a factor of cost escalation if it becomes difficult to paste a constituent and it blends a dispersing agent superfluously rather than a mentioned range on the other hand if an organic solvent is not used, it is not desirable.

[0065]Next, an example of a pattern formation method using a photosensitive paste composition by this invention is explained. First, a partition pattern formation method by the lift-off method using a photosensitive paste composition is explained with reference to drawing 2. As shown in drawing 2 (A) and (B), on the transparent substrate 11 (generally glass substrate) used as a back plate of PDP, the photographic sensitive film 12 is laminated and the slot 13 of a predetermined pattern is formed with a photographic method. As the method is first shown in drawing 2 (A), after sticking the photographic sensitive film 12 on the surface of the transparent substrate 11 as usual, The photo mask 14 which has the predetermined pattern state through hole portion 15 is piled up, exposure and development are performed after an appropriate time, and a portion of a photographic sensitive film which was not exposed through a photo mask as shown in drawing 2 (B) is removed. When using a transparent substrate by which an electrode of a prescribed pattern was formed in a substrate face, it piles up on a photographic sensitive film so that a pattern state through hole portion of a photo mask may consistent with an electrode position.

[0066]Subsequently, as shown in drawing 2 (C), after applying to the slot 13 between the above-mentioned exposure and a pattern of the photographic sensitive film 12 formed by development so that the photosensitive paste composition 16 of this invention of a presentation described above by a proper method may be embedded and defoaming to it under decompression preferably, it exposes to it and it is made to carry out photo-curing. As an exposure light source, a low-pressure mercury lamp, a medium pressure mercury lamp, an extra-high pressure mercury lamp, A xenon lamp, a carbon arc lamp, a metal halide lamp, a fluorescent lamp, A halogen lamp, an Ar ion laser, a helium cadmium laser, helium neon laser, krypton ion laser, various semiconductor lasers, an YAG laser, a light emitting diode, etc. can be used. Then, the hardened glass paste surface is ground until the photographic sensitive film 12 comes to appear (drawing 2 (D)).

[0067]As a remover the obtained substrate 11 Thus, an alkaline aqueous solution, For example, after dipping in a remover solution for abbreviation 15 to 20 minutes using 40 **, a 3 to 5% NaOH aqueous solution, 10wt% monoethanolamine solution, etc., by dipping in around 40 ** water for tens seconds, the photographic sensitive film 12 swells promptly and it separates. As shown in drawing 2 (E), after the exfoliative substrate's 11 washing the photographic sensitive film 12 and drying, a glass paste hardened material is calcinated at temperature of about 380 ** - about 600 ** for example, in the air or under a nitrogen atmosphere. At this time, it is preferred to put in a process of heating at about 300 ** - 500 **, carrying out predetermined time maintenance at that temperature as a preceding paragraph story of a baking process, and removing an organic component.

[0068]By such a process, the highly precise PDP partition wall pattern 16a of uniform height without disorder 30-100 micrometers in width and about 100-200 micrometers in height is obtained. It can laminate on a substrate and

liquefied developed type photosensitivity resist of negatives besides a photographic sensitive film (dry film) can be used as a material of a film which forms a slot of a prescribed pattern. Even if it is after passing through photo-curing of a photosensitive paste composition as a material of the above-mentioned film, what can exfoliate easily in an alkaline aqueous solution is used suitably.

[0069]In said method carried out, although how to make it exfoliating with drugs (remover) as a removing method of a photographic sensitive film was explained, a method of making calcination of glass paste, simultaneously a photographic sensitive film burned down is also possible. However, in the case of a method of also burning and removing a photographic sensitive film simultaneously in the case of calcination of glass paste, there is a possibility of destruction-by-fire residue of a photographic sensitive film remaining, and producing a black stigma in a picture between septa, and this becomes a factor which reduces quality of PDP greatly. Therefore, a method of using a remover as a removing method of a photographic sensitive film, as described above is preferred.

[0070]Next, a baked material pattern formation method by the photolithographic method using an alkaline development type photosensitive paste composition is explained with reference to drawing 3. First, as shown in drawing 3 (A), an alkaline development type photosensitive paste composition is screen-stenciled, It applies to a glass plate which turns into the transparent substrate 11, for example, a front substrate of PDP, with proper coating methods, such as a bar coating machine and a braid coating machine, Subsequently, when using an organic solvent into a constituent, in order to obtain set-to-touch nature, it is made to dry about 5 to 40 minutes at about 60-120 °C with a hot wind circle method drying furnace, a far-infrared drying furnace, etc., an organic solvent is evaporated, and 17 is formed for a tack-free coat. Then, as shown in drawing 3 (B), the photo mask 14 which has a predetermined exposure pattern is piled up on the above-mentioned coat, selective exposure and development are performed, and the coat 17 of a prescribed pattern is formed (drawing 3 (C)). Subsequently, it calcinates and the predetermined baked material pattern 17a as shown in drawing 3 (D) is formed.

[0071]Although contact exposure and non-contact exposure using a negative mask which has a predetermined exposure pattern are possible as an exposure process, from a point of resolution, contact exposure is preferred. As an exposure light source, a halogen lamp, a high-pressure mercury-vapor lamp, a laser beam, a metal halide lamp, a black lamp, an electrodeless lamp, etc. can be used.

[0072]A spray method, the dipping method, etc. are used as a developing process. As a developing solution, sodium hydroxide, a potassium hydrate, sodium carbonate, Although amine aqueous solutions, such as metal alkaline aqueous solutions, such as potassium carbonate and a specific silicate, monoethanolamine, diethanolamine, triethanolamine, especially dilute-alkali solution of about 1.5 or less % of the weight of concentration are used suitably, A carboxyl group of resin having carboxyl groups in a constituent is saponified, a non-hard spot (unexposed part) should just be removed, and it is not limited to the above developing solutions. It is preferred rinsing and to perform acid neutralization because of removal of a developing solution unnecessary after development.

[0073]In a baking process, about 380-600 °C heat-treatment is performed for a substrate after development in the air or under a nitrogen atmosphere, and a desired pattern is formed. At this time, it is preferred to put in a process of heating at about 300-500 °C, carrying out predetermined time maintenance at that temperature as a preceding paragraph story of a baking process, and removing an organic matter.

[0074]

[Example]although an example and a comparative example are shown below and this invention is concretely explained to it, it comes out that this invention is not what is limited to the following example from the first. It is a

weight reference altogether that it is especially with a "part" and "%", as long as there is no notice.

[0075]Preparation of a photosensitive paste composition: It blended in the composition ratio shown below, and with the agitator, after stirring, it milled by 3 roll mills and pasting was performed. As glass particles, PbO 60%, B₂O₃20%, The glass frit of SiO₂15% and aluminum₂O₃5% of presentation was ground, and coefficient-of-linear-expansion $\alpha_{300}=70 \times 10^{-7}/^{\circ}\text{C}$, 445 $^{\circ}\text{C}$ of glass transition points, and a thing with a mean particle diameter of 1.6 micrometers were used.

[0076]

Example of constituent 1 glass-particles copolymerization oligo acrylate 83.3 copies (OSAKA ORGANIC CHEMICAL INDUSTRY, LTD. make and ruler M101;) Alumina 12.5 copies Titanium oxide 4.2 copies The acrylic acid adducts of a methacrylic acid ester copolymer. Copies [2.0] Diethylene-Glycol Dimethacrylate 2.0-Copy Dispersing Agent 15.0 Copies (Product made by Big KEMI.) 1 -(4-PhenylSulfanilPhenyl)- Octan-1-One Oxime O-Acetate (made by Ciba Specialty Chemicals) Disperbyk-101 0.5 copy[0077]

example of constituent 2 glass-particles copolymerization oligo acrylate 83.3 copies (the OSAKA ORGANIC CHEMICAL INDUSTRY, LTD. make.) Alumina 12.5 copies Titanium oxide 4.2 copies ruler M101 2.0 copy Diethylene-glycol dimethacrylate 15.0 copies 1 -(4-phenylsulfanilphenyl)- octan-1-one oxime O-acetate (made by Ciba Specialty Chemicals). Copies [2.0] 0.2 Copy of Diethylthio Xanthone Dispersing Agent (Product made by Big KEMI, Disperbyk-101) 0.5 Copy[0078]

example of comparison constituent 1 glass particles (the OSAKA ORGANIC CHEMICAL INDUSTRY, LTD. make.) 83.3 copies Alumina 12.5 copies Titanium oxide 4.2 copies Copolymerization oligo acrylate ruler M101 2.0 copy Diethylene-glycol dimethacrylate 15.0 copies The 2-benzyl-2-dimethylamino 1 -- (4-morpholinophenyl) butan-1-one (IRGACURE 369, Ciba Specialty Chemicals make). Copies [2.0] Dispersing Agent (Product made by Big KEMI, Disperbyk-101) 0.5 Copy[0079]The photosensitive dry film was stuck for the above-mentioned examples 1-2 of a constituent, and the example 1 of a comparison constituent on the glass substrate, and it applied so that a squeegee might be used and embedded in the slot 170 micrometers in height, and 55 micrometers in width which formed the predetermined pattern with the photographic method and was made. Subsequently, the glass substrate which applied the glass paste composition in this way was exposed so that the light exposure on the surface of a paste might serve as 140 mJ/cm² using a metal halide lamp (HMW-680GW, 7 kW), and glass paste was stiffened. Then, after grinding the hardened paste surface until a dry film came to appear and dipping this glass substrate in 40 $^{\circ}\text{C}$ and a 5% NaOH aqueous solution for 15 minutes, shortly after dipping in 40 $^{\circ}\text{C}$ water after raising, the dry film exfoliated. The exfoliative glass substrate washed the dry film in cold water lightly. Thus, after forming a glass paste hardened material, it calcinated in the air using the electric furnace. From a room temperature to 450 $^{\circ}\text{C}$, with 10 $^{\circ}\text{C}$ the heating rate for /, temperature up of the calcination is carried out and it is held for 30 minutes. Then, it carried out at the process which carries out temperature up, is held for 30 minutes, is calcinated to 525 $^{\circ}\text{C}$ with 10 $^{\circ}\text{C}$ the heating rate for /, and is cooled radiationally to a room temperature after that.

[0080]alkaline development type photosensitive paste composition preparation:- -- synthetic example: -- a thermometer and an agitator. Methyl methacrylate and methacrylic acid are taught to a dropping funnel and the flask provided with the reflux condenser by the mole ratio of 0.76:0.24, Dipropylene glycol monomethyl ether was put in as a solvent, azobisisobutyronitrile was put in as a catalyst, it stirred at 80 $^{\circ}\text{C}$ under a nitrogen atmosphere for 2 to 6 hours, and the resin solution was obtained. Cool this resin solution, use methylhydroquinone as polymerization

inhibitor, use tetrabutylphosphonium bromide as a catalyst, and glycidyl methacrylate at 95-105 °C on the conditions of 16 hours. To 1 mol of carboxyl groups of the above-mentioned resin, by the addition mole ratio with a rate of 0.12 mol, the addition reaction was carried out and it took out after cooling. As for the weight average molecular weight of the resin A generated by the above-mentioned reaction, 59 mgKOH/g and the double bond equivalent of about 10 and 000 acid value were 950. Measurement of the weight average molecular weight of the obtained copolymerization resin was measured with the high performance chromatography which connected Shimadzu Corp. make pump LC-6AD, Showa Denko K.K. make column Shodex(registered trademark) KF-804, KF-803, and three KF-802.

[0081] It blended in the composition ratio shown below using the resin A obtained in the above-mentioned synthetic example, and with the agitator, after stirring, it milled by 3 roll mills and pasting was performed. As glass particles, PbO 60%, B₂O₃ 20%, The glass frit of SiO₂ 15% and aluminum₂O₃ 5% of presentation was ground, and coefficient-of-linear-expansion $\alpha_{300}=70 \times 10^{-7}/^{\circ}\text{C}$, 445 °C of glass transition points, and a thing with a mean particle diameter of 1.6 micrometers were used.

[0082]

The example 3 of a constituent. The resin A. Copies [100.0] Pentaerythritol -- Doria -- KURIRETO . Copies [50.0] Dipropylene Glycol Monomethyl Ether . Copies [80.0] Black Pigment 150.0 Copies Glass Particles 500.0 Copies 1 -(4-PhenylSulfanylPhenyl)- Octan-1-One Oxime O-Acetate (made by Ciba Specialty Chemicals) 10.0 Copies[0083]

The example 4 of a constituent. The resin A. Copies [100.0] Pentaerythritol -- Doria -- KURIRETO . Copies [50.0] Dipropylene Glycol Monomethyl Ether . Copies [80.0] Black Pigment 150.0 Copies Glass Particles 500.0 Copies 1 -(4-PhenylSulfanylPhenyl)- Octan-1-One Oxime O-Acetate (made by Ciba Specialty Chemicals) 10.0 Copies Diethylthio Xanthone 1.0 Copy[0084]

The example 5 of a constituent. The resin A. Copies [100.0] Pentaerythritol -- Doria -- KURIRETO . Copies [50.0] Dipropylene Glycol Monomethyl Ether 80.0 Copies Silver Dust 450.0 Copies Glass Particles 22.0 Copies 1 -(4-PhenylSulfanylPhenyl)- Octan-1-One Oxime O-Acetate (made by Ciba Specialty Chemicals) 5.0 Copies[0085]

The example 6 of a constituent. The resin A. Copies [100.0] Pentaerythritol -- Doria -- KURIRETO . Copies [50.0] Dipropylene Glycol Monomethyl Ether . Copies [80.0] Silver Dust 450.0 Copies Glass Particles 22.0 Copies 1 -(4-PhenylSulfanylPhenyl)- Octan-1-One Oxime O-Acetate (made by Ciba Specialty Chemicals) 5.0 Copies Diethylthio Xanthone 0.2 Copy[0086]

example of constituent 7 resin A 100.0 copy pentaerythritol -- doria -- KURIRETO 50.0 copies Dipropylene glycol monomethyl ether 80.0 copies Silver dust 150.0 copies Glass particles 25.0 copies Black pigment 100.0 copies . 1 -(4-phenylsulfanylphenyl)- Octan-1-one oxime O-acetate (made by Ciba Specialty Chemicals) 10.0 copies[0087]

example of constituent 8 resin A 100.0 copy pentaerythritol -- doria -- KURIRETO 50.0 copies Dipropylene glycol monomethyl ether 80.0 copies Silver dust 150.0 copies Glass particles 25.0 copies Black pigment 100.0 copies . 1 -(4-phenylsulfanylphenyl)- Octan-1-one oxime O-acetate (made by Ciba Specialty Chemicals) 10.0 copies Diethylthio xanthone 1.0 copy[0088]

example of comparison constituent 2 resin A 100.0 copy pentaerythritol -- doria -- KURIRETO 50.0 copies Dipropylene glycol monomethyl ether 80.0 copies Black pigment 150.0 copies Glass particles 500.0 copies 2-benzyl-2-dimethylamino 1- (4-morpholinophenyl)-butan-1-one 10.0 copies[0089]

example of comparison constituent 3 resin A 100.0 copy pentaerythritol -- doria -- KURIRETO 50.0 copies
Dipropylene glycol monomethyl ether 80.0 copies Silver dust 450.0 copies Glass particles 22.0 copies 2-benzyl-2-
dimethylamino 1- (4-morpholinophenyl)-butan-1-one 5.0 copies[0090]

example of comparison constituent 4 resin A 100.0 copy pentaerythritol -- doria -- KURIRETO 50.0 copies
Dipropylene glycol monomethyl ether 80.0 copies Silver dust 150.0 copies Glass particles 25.0 copies Black pigment
100.0 copies . 2-benzyl-2-dimethylamino 1 -- (4-morpholinophenyl) Butan-1-one 10.0 copies[0091]Using the above-
mentioned examples 3-8 of a constituent, and the examples 2-4 of a comparison constituent, on the glass substrate,
the polyester screen of 300 meshes was used and it applied on the whole surface. Next, using the hot wind circle
method drying furnace, it dried for 20 minutes at 90 **, and the good coat of set-to-touch nature was formed.
Subsequently, using the negative film of the pattern of the stripe shape used as the linewidth of 100 micrometers, and
the space width of 100 micrometers, the light source was used as the metal halide lamp, and it exposed so that the
addition light volume on a constituent might serve as 500 mJ/cm². Then, it developed negatives and rinsed using the
1wt%Na₂CO₃ solution of 30 ** of solution temperature. Finally the electric furnace was used and it calcinated in the
air. Temperature up of the calcination is carried out with 5 ** the heating rate for /from a room temperature to 450
**, and it is held for 30 minutes at 450 **.

Then, the process which carries out temperature up, is held for 30 minutes, is calcinated to 550 ** with 5 ** the
heating rate for /, and is cooled radiationally to a room temperature after that was performed.

[0092]About each obtained substrate, the evaluation result of each evaluated characteristic is shown in Table 1.

[Table 1]

特性	組成物例								比較組成物例			
	1	2	3	4	5	6	7	8	1	2	3	4
(1)ハター形成後のライン形状	○	○	○	○	○	○	○	○	○	○	○	○
(2)焼成後のライン形状	○	○	○	○	○	○	○	○	△	○	○	○
(3)密着性	○	○	○	○	○	○	○	○	△	○	△	△
(4)ハターエッジのカーブ	○	○	○	○	○	○	○	○	○	△	△	△

The valuation method in Table 1 is as follows.

[0093](1) observing the pattern after the development in the pattern by a hardened material and alkaline development
type photosensitive paste composition after the dry film exfoliation in the line shape photosensitive paste
composition after pattern formation under a microscope, and there being no irregular dispersion in a line, and getting
twisted -- etc. -- it was evaluated whether there would be nothing or not. The valuation basis is as follows.

O : -- there being no irregular dispersion and getting twisted -- etc. -- there is nothing.

** : -- a little irregular -- varying and getting twisted -- etc. -- it is.

x : -- irregular -- varying and getting twisted -- etc. -- it is.

[0094](2) the line shape after the line shape calcination after calcination observing under a microscope the pattern
ended to calcination, and there being no irregular dispersion in a line, and getting twisted -- etc. -- it was evaluated
whether there would be nothing or not. The valuation basis is as follows.

O : -- there being no irregular dispersion and getting twisted -- etc. -- there is nothing.

** : -- a little irregular -- varying and getting twisted -- etc. -- it is.

x : -- irregular -- varying and getting twisted -- etc. -- it is.

[0095](3) It was evaluated whether adhesion would perform peeling by cellophane adhesive tape, and would have exfoliation of a pattern. The valuation basis is as follows.

O : there is no exfoliation of a pattern.

** : There is exfoliation of a pattern a little.

x : There is often exfoliation of a pattern.

[0096](4) Curl of the curl pattern edge of pattern edge measured and evaluated the surface roughness of pattern edge with the surface roughness plan. The valuation basis is as follows.

O : there is almost no edge curl.

** : There is an edge curl a little.

x : An edge curl is severe.

[0097]

[Effect of the Invention]As mentioned above, since according to the photosensitive paste composition of this invention it excels in a photoresist or resolution and the outstanding photo-curing depth is shown, it becomes difficult to produce photo-curing unevenness, and definition can be raised. Therefore, it is hard to produce the curvature in the case of calcination, and line width contraction, and a high aspect ratio and highly precise pattern processing become possible. In the case of the same thickness, the minimum light exposure which can form the same line/space pattern can be lessened, and energy saving can be realized. Therefore, baked material patterns, such as a high aspect ratio and a highly precise partition pattern, an electrode pattern, a dielectric pattern, and a black matrix pattern, can be formed with sufficient productivity by high yield in production of a plasma display panel.

[Translation done.]